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THE INFLUENCE OF UNFAVOURABLE FEEDING CONDITIONS ON THE SURVIVAL AND FECUNDITY OF ORIENTAL FRUIT MOTHS.

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In connection with our studies on the Oriental fruit moth, large numbers of the insect are reared in the insectary on apples. The fruit moth eggs are placed on apples in closed containers such as No. 10 tins, and when the larvae are mature the majority of them come to the top of the containers and are placed on strips of corrugated paper in lantern globes for pupation and emergence. The remaining larvae are allowed to pupate and emerge in the rearing containers.

As some of the observations made in this mass rearing work indicated that insectary feeding conditions may affect the size and fecundity of the moths, an experiment, the details of which are given in the appended table, was undertaken. Briefly, we used two lots of apples of known weight and added 2 eggs per apple to one lot, and 10 eggs per apple to the other. One test thus had 240 eggs on 120 apples with a total weight of 2 lbs., 6 ozs., and the other had 600 eggs on 60 apples with a total weight of 1 lb., 2 ozs. The eggs were laid on June 14, 1934, the first mature larva was obtained 18 days later on July 2, and the first adult on July 14. There were no appreciable differences between the two lots in the length of the development time for the different stages.

SUMMARY OF FEEDING EXPERIMENT

Type of Data	No. 1	No. 2
Total number of apples	120	60
Total weight of apples	2 lbs. 6 ozs.	1 lb. 2 ozs.
Total Eggs	240	600
Number of eggs per apple	2	10
Ounces of apple per egg	.15	.03
Ounces of apple per one resulting adult	.18	.06
Mature larvae put in globes	113	149
Total adults from globes	109	114
Pupal mortality	3.5%	23.5%
Adults from rearing containers	95	204
Total males (globes and cans)	103	185
Total females (globes and cans)	101	133
Mortality from egg to adult	10.8%	47.0%
Total eggs from females	3944	1931
Number of eggs per female	39.0	14.5

The results are quite marked, and show that, as compared to favourable feeding conditions, the crowded condition of 10 eggs per apple produced, (1) a much greater total mortality from egg to adult—47 per cent as compared to 10.8 per cent, (2) a similarly higher mortality during pupation—23.5 per cent as compared to 3.5 per cent, and (3) a decrease in female fecundity from 39 eggs per female to 14.5 eggs per female.

The average weight of a mature fruit moth larva is approximately .0056 ounces. Under the conditions of 2 eggs per apple each mature moth had approximately 32 times its larval weight of apple, while those under the crowded

feeding conditions had approximately only 10 times the larval weight of apple for each mature moth produced.

The apples used for the experiment were approximately 1 inch or less in diameter. A medium sized apple of about 2½ inches in diameter weights about 4 ozs. and could under the favourable conditions described above, bring through to maturity about 20 moths from about 23 or 24 eggs. Several more experiments would be necessary to show how many more efficient moths could be reared per apple before the unfavourable condition of approximately 80 moths per 4 oz. apple is reached.

In the field, larvae very rarely have to feed under crowded conditions either in the fruit or twigs. However, unfavourable conditions such as poor succulence of the twigs, or the hardness or gumminess of the fruit ,might lead to the production of moths with a lower biotic potential.

NOTES ON THE HABITS OF ATTACK OF THE HEMLOCK BORER

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The hemlock borer (*Melanophila fulvoguttata* Harr.) belongs to a buprestid genus, the larvae of which bore in the bark and cambial area of the stems of conifers. They generally breed in trees which have been weakened, injured, or recently felled. Several species, however, including *fulvoguttata,* are reported to be capable of attacking and killing healthy trees and doing a large amount of damage. In other words, they belong to that class of cambial feeders which normally finds conditions most favorable when the host is about to die, but occasionally appears to be capable, when numerous, of breeding in healthy trees which would otherwise live. They are faculative tree killers.

It is not always easy to tell whether trees so attacked are healthy or whether they are suffering from some weakening influence. It is necessary, therefore, when such species are found apparently killing trees to examine the possibilities of conditions which may have seriously reduced the normal resistance of the host. It will often be found that the trees have been subjected to drought, unfavourable soil conditions, exposure to sun scald or wind strain, attack by a fungus or another insect, or are approaching the age limit of the species in that particular district. The degree to which such predisposing factors are present will determine the actual "aggressiveness" of the borer; whether it is a primary or secondary factor in the death of the host.

Some of the references in the literature to the destructive propensities of *M. fulvoguttata* suggest that outbreaks are generally dependent on the trees being weakened by drought or poor sites [1, 4]. Others indicate definitely that large numbers of healthy trees are frequently killed, although details are not given [2, 3, 5]. A situation developed recently in Queens County, N. S., which illustrated the importance of having exact knowledge on this point.

In the neighborhood of Lake Rossignol there are some of the finest pure stands of hemlock in Eastern America. Although mostly overmature from a forester's point of view, they are in good condition, and the trees, which stand

Contribution from Division of Forest Insects, Entomological Branch, Department of Agriculture, Ottawa.

up to 100 feet in height, show few signs of decadence. They are valuable as pulpwood and as a relic of the virgin forest. Where the hemlock does not occur in pure stands it grows mixed with other species. In 1929, some cutting was done in connection with a large power development which was to raise the water of the lake. The hemlock logs were left unpeeled and during the summer were completely filled with *M. fulvoguttata*. In order to reduce the danger of an outbreak, these logs were to have been placed in the water, but the operation was ineffective owing to misjudging the height the water would reach. A very high emergence took place from the logs. Some were in the water for ten days but this did not kill the larvae.

In 1930, the level of the lake was raised about ten feet and the trees around the edge of this large body of water had their roots submerged in the spring. An examination in the autumn showed that every hemlock which was submerged for a month or more had been heavily attacked by the borer but that no tree above this level, even if decadent and stagheaded, had been attacked. It was evident from the other tree species that these infested hemlocks would all have been killed by the water.

In view of the reported aggressiveness of *M. fulvoguttata* there appeared to be great danger of the large numbers of the beetle which would emerge in 1931 turning their attention to the neighbouring living timber. Owing to the uncertainty regarding this point, however, and to the scattered distribution of the affected trees, control by cutting was not recommended. Also, the water level was to be raised again in 1931 and a further supply of drowned hemlock would help to absorb the attack.

In 1931, the number of hemlocks newly submerged was considerably smaller than in the previous year. In spite of this the borer attacked only those trees which were drowned by the water. Again, the limit of the infested area coincided with the contour of the water level which was held for approximately a month or more.

If *fulvoguttata* is capable of attacking living trees, this behaviour at Lake Rossignol could only be explained by factors of natural control having kept the numbers down sufficiently so that there were only enough beetles to attack the drowned trees. During the winter of 1930-31, woodpeckers had been quite active and also a species of *Coeloides* had destroyed a number of the larvae in 1930. In addition, some of the larvae within one or two feet of the water level had died, evidently as a result of the water affecting conditions in the bark. However, although no exact quantitative study was possible, it did not seem probable from the numerous observations made that these factors were sufficient to prevent some increase of the numbers in 1931. Unless an actual decrease took place it would be reasonable to conclude that the beetles were unable to attack living trees. Also, the heavy and successful attack in 1930 on all drowned trees, combined with complete failure to enter even overmature living trees, supports this conclusion. A few attacks on living trees were noted but they were unsuccessful in that the young larvae died and the trees lived.

In the case of the cutting operation, it was noted that the beetle found conditions very favourable in unpeeled cull logs, and in some of the larger tops if the bark was thick enough. Stumps were, however, not generally favourable

owing to the amount of moisture forced up into them by the roots. High stumps sometimes had larvae in them on the south side, where the bark was dried somewhat by the sun. Larvae were also more numerous in the logs on the sunny side and no evidence was found of mortality from high subcortical temperatures where they were exposed to sun. The submerged trees were satisfactory for breeding except within one or two feet of the water.

It would seem, therefore, that in Nova Scotia *M. fulvoguttata* is unlikely to attack healthy timber, since it has failed to do so in the above apparently favourable circumstances, and that it is confined to recently cut trees, dying trees, or those which have been seriously weakened.

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COMMENTS ON MARTEN'S SPECIES OF TABANIDAE (HORSEFLIES) FROM WESTERN UNITED STATES

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In the Canadian Entomologist (1882 and 1883) Marten describes 7 species of *Tabanus* from the western United States of which the location of the types is unfortunately unknown. Certain characters now considered essential for comparative analysis were not adequately treated by him and as the descriptions were apparently based on damaged specimens in 2 instances, and on very restricted numbers in others, some confusion has arisen as to the identity of certain of these species. Although Williston (1886) notices the species of the 1883 paper, Hine (1904) appears to have been the first to attempt adequate interpretation of Marten's species. McDunnough (1921) in revising the *affinis* group of *Tabanus* further considered certain of these species. As a result of these studies we now feel confident of the identity of his *T. californicus, T. captonis* and *T. haemaphorus* "from California"; these 3 have also been taken by the writer in Montana.

The type locality of 3 other species is given by Marten as "from Montana", viz: *T. tetricus, T. frenchii* and *T. susurrus*. These and his *T. centron* "from Colorado", have been confused by Hine and others, with a number of different horseflies which have come under the observation of the writer.

Certain disease transmission studies with indigenous horseflies at western institutions, notably experimental tularaemia and equine encephalomyelitis, have required that definite information be available concerning the species utilized. The writer has been making incidental observations and collections of Montana

Contribution from the Rocky Mountain Laboratory of the United States Public Health Service, Hamilton, Montana.

species of Tabanidae since 1926. With my own considerable collection of Montana materials and those of the State College at Bozeman available, I have been attempting to identify Marten's problematical species. As Marten apparently did not have extensive series of specimens at his disposal it appeared probable that at least some of the troublesome species (discussed below) should represent common forms or their variations.

T. tetricus Marten, Can. Ent. 15:110, from Montana.

Williston and Hine considered this as "something like *rhombicus* but with red antennae" (Marten, however, states "third joint black"). The size and many of the characters incline the writer to the belief that Marten had before him a variation of *T. hirtulus* with denuded subcallus and a "greased" head, although he does not mention the characteristic spur on the fork vein of the wing. *T. hirtulus* is perhaps the most prevalent species in western Montana, and in a long series, about one-fifth show various degrees of denudation of the subcallus so that in some specimens this structure is completely denuded in otherwise well preserved specimens. These flies are otherwise structurally and tinctorially the same. As depilation of other nearby structures has infrequently occurred, the cause of even slight denuded shining spurs on the subcallus is seldom mechanical in the specimens studied. Marten mentions "front black" and "face and cheeks black with white hairs" in describing this and *T. frenchii;* in some hundreds of western specimens examined by the writer, none but "greased" examples have ever been seen with these characters (certain dark species not possible of confusion, *T. sequax* and *T. procyon,* are normally closest in this respect). The opinion that "greased" specimens were involved for this and *T. frenchii* following is further strengthened by the statement of "subcallus black" for the latter without mention of its being denuded. *T. melanorhinus* is close but much smaller, the third antennal joint is reddish basally with a considerable prominence, and the palpi have black as well as white hairs.

I have before me one specimen by Hine and two by McDunnough, determined as *T. tetricus* which are unquestionably *T. hirtulus,* but only one has denuded subcallus and none has black front, face or cheeks. On the other hand, another specimen of *T. hirtulus* with "greased" head and denuded subcallus, fits Marten's description perfectly with the addition of the wing spur.

For the purpose of keying, it may be necessary to retain the name as a variety of *hirtulus,* but inter-grades of variation in a character that in other species seems quite constant, preclude its complete specific separation in my estimation.

T. frenchii Marten, Can. Ent. 15: 111, from Montana.

Williston suggests relation of this to *T. microcephalus.* Hine interprets it as having "base of the anterior branch of the third vein with a stump" and "red beneath the lateral gray abdominal spots", in addition to the characters described by Marten. Of 4 specimens seen in Hine's collection as this species, a male and two females from Wyoming are typical *T. hirtulus,* with which species he undoubtedly had *T. frenchii* confused. The fourth specimen from New Mexico with Hine's determination is near, if not identical with, *T. atrobasis* McD.

Unfortunately, as suggested above, Marten apparently described a specimen with a "greased" head, and he states nothing with regard to the color pattern of the triangles on the "black abdomen." The red antennae without "prominent

angles" and with only the annuli black (compare with *T. tetricus* and *T. susurrus*) yellowish palpi, 3 rows of (supposedly gray) triangles, faint clouds on the wings and 14 mm. in length, denotes no species with which the writer is familiar. It is assumed the subcallus is not denuded although "black", since Marten has not failed to state such denudation where it occurred in his other species. Either coloration of antennae or of wings with faint clouds eliminate consideration of *T. opacus, T. hirtulus,* or *T. frontalis,* which are all common Montana species and must be near it. The abdomen in particular is insufficiently characterized, without study of the missing type, to allow placement of *T. frenchii,* in spite of a considerable quantity of available material from the type state.

T. susurrus Marten, Can. Ent. 15: 112, from Montana.

Williston relates this species also, to *T. rhombicus.* Hine considers it to have "red on the sides of first 3 or 4 segments" ("beneath the lateral grey abdominal spots", in his key) and "no stump on the anterior branch of the third wing vein", additional to Marten's characterization. The original description is again deficient in giving us an idea of the true abdominal coloration. One would assume from the "brownish-yellow" venter that the two rows of triangles above would have a reddish cast, and, except for the "faint dorsal brownish stripe", the size and general description best fit *T. illotus* O. S., which is rather rare in Montana, and which species Marten probably knew. *T. frontalis* Walk. a rather variable, common, Montana species, has a tendency toward such a stripe as does *T. insuetus* O. S., but the "angle prominent" of the antennae, "palpi yellow" and "brown ocelligerous tubercle" with other head and wing characters, make these unlikely assignations. The description agrees with no specimens the writer has seen. The name appears to have been most frequently applied to variants of *T. frontalis.*

T. centron Marten, Can. Ent. 14: 212, from Colorado.

Hine considered this identical with Osten Sacken's (1875) second form of *T. rhombicus,* which the latter described as having "subcallus either not or partially denuded; stump or vein present in most, not all specimens." However, Hine must have erred in this, as Marten's *T. centron* has the subcallus denuded and there is no mention of the presence of such a stump (which Marten may have omitted, however, as suggested above). The only character in which *T. centron* disagrees radically with Osten Sacken's remarks for typical *rhombicus* having yellowish-brown costal cell, denuded subcallus, abdominal triangles, etc., is the difference of "front narrow" as opposed to the "comparatively broad front" of *T. rhombicus* a relative matter which could vary with the judgment of different students. The latter species is common in collections from Colorado and the writer considers *T. centron* to be synonymous.

The "brownish-black characterization of the abdomen apparently related the species to the red-sided group in Professor Hine's opinion, as the writer has seen specimens bearing his label which are actually *T. rupestris* McD. The "flesh-colored" dashes on the sides of the abdomen of typical specimens of the latter, are not sufficiently pronounced to be characterized in Marten's terms. One specimen each of *rupestris* from Wyoming and from Utah has been studied but none has turned up from Colorado, a fact which further supports the above synonymy.

In passing, it may be mentioned that, in the opinion of the writer, Osten Sacken's second form of *rhombicus* in the main refers to *T. hirtulus,* specimens

of which have also been studied from Colorado and in which the amount of pollinosity of the subcallus varies, as discussed previously.

STATUS OF MARTEN'S SPECIES AS CONSIDERED ABOVE.

T. californicus, "from California"; also known from Oregon, Washington, Montana, and British Columbia.

T. captonis, "from California"; also known from the above localities, and Idaho.

T. haemaphorus, "from California"; also known from the above localities and Wyoming, Colorado and Arizona.

T. hirtulus Bigot. *syn. T. tetricus* Mart. "from Montana." Also known from British Columbia, Alberta, Saskatchewan, Washington, Oregon, Idaho, Wyoming, Utah and Colorado.

T. rhombicus Osten Sacken. *syn. T. centron* Mart. "from Colorado". Add to the same known localities of *T. hirtulus,* California.

T. frenchii Marten "from Montana"—unrecognizable.

T. susurrus Marten "from Montana"—unrecognizable.

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NOTES ON WESTERN SPECIES OF EPHEMEROPTERA*

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As our knowledge of the western Ephemerid fauna, particularly in its nymphal stages, increases, our conception of the individual species becomes more accurate, necessitating in some instances corrections of previous statements, and enabling us to differentiate closely allied species in various groups which heretofore had been lumped under one name. The basis for the following notes has been the rearings carried on by my assistant, Mr. A. N. Gartrell, in the Okanagan region of British Columbia in 1934.

Ephemerella flavilinea McD.

This species was originally described from a single male from Waterton Park, Alta. (1926, Can. Ent. LVIII, 188). Later, (1929, Can. Ent. LXI, 169, Pl. III, fig. 3) I gave a figure of the genitalia of the type as contrasted with those of *coloradensis* Dodds and was inclined to associate under the name a series of nymphs and adults taken at the Firehole River, Yellowstone National Park, Wyo., in late July. Following this determination Walley (1930, Can. Ent. LXII, 18, Pl. I, figs. 1a, 1b, 1c; Pl. II, figs. 3, 3a) described the Yellow-

*Contribution from the Division of Systematic Entomology, Entomological Branch, Department of Agriculture, Ottawa.

stone nymphs as those of *flavilinea*, figuring a full-grown one and giving certain details of structure.

Since the above notes were published we have received additional material in the shape of another male from Waterton and a small series of both sexes from the Crow's Nest Pass region, (Blairmore, Lundbreck) about 40 miles from the type locality. The Waterton specimen, evidently quite fully mature, is even ruddier in its abdominal coloration than the type and shows very clearly the ruddy spots on the coxae (mentioned in my second paper) which are only very faintly visible in the original specimen. The Crow's Nest males agree closely in all respects with the type; they appear to have been reared from subimagoes and are slightly teneral, showing, therefore, less development of the ruddy shades; the females (also somewhat teneral) match up quite well with the captured females from Bozeman, Mont., from which I drew up a description of this sex (1929, *op. cit.* 169).

In 1933 I took a series of 5 males and 17 females at Seton Lake, B. C. (mostly at light) which, while considerably larger, especially in the female sex, and deeper in coloration, appeared referable to *flavilinea* on the strength of similar genitalia and pale wing-venation. Finally in 1934 Mr. Gartrell was successful in breeding a series of 1 male, 4 females, very similar to my Seton Lake series. These specimens with their nymphal skins, as well as a small series of mature nymphs from the same locality (Shingle Creek, near Penticton, B. C.) have been studied. The larger size of the British Columbia specimens is, to my mind, of no specific value, and probably due to lower altitudes and temperature conditions of the water. Further, the Penticton nymphs agree (apart from size) with two nymphs in our collection taken from small streams in the Crow's Nest Pass, an additional proof possibly that the two forms belong to the same species. On the other hand the Yellowstone Park nymphs show structural distinctions which while small are seemingly constant and make a separation from *flavilinea* apparently necessary.

The true *flavilinea* nymph is of the *coloradensis* type and very similar to Walley's figure (op. cit. Pl. II, fig. 3). The characteristic feature is found in the so-called "dorsal abdominal tubercles," or dorsal projections from the posterior margin of each segment; these are *much flattened* and scarcely elevated at all from the segmental plane; they are quite broad at the base, tapering sharply to a blunt, rounded apex, and are feebly granulate.

Ephemerella lapidula n. sp.

Ephemerella flavilinea Walley (nec McD.) 1930, Can. Ent. LXII, 18.

Nymph.—Very close to that of *flavilinea*, differing principally in the shape of the dorsal abdominal tubercles; these are slightly longer, especially on the eighth segment, distinctly more pointed apically and *noticeably projecting upward* above the plane of the segment. In a long series of mature nymphs taken in the Firehole River, Yellowstone Park, Wyo. (July 22, 27, 28) this feature is quite constant and I therefore accord it specific value for the present. No actual breedings took place at the time but subimagoes were captured as they emerged from the same spot and from these a small series of adults was secured, so that the association is fairly certain.

Male.—Scarcely separable from *flavilinea*; somewhat larger than typical Alberta specimens but smaller than British Columbia ones. The ruddy suffusion of *flavilinea* is replaced by blacker shades, especially on femora and ventral surface of abdomen. In the genitalia the terminal joint of the forceps (based on a single slide) is distinctly longer than in *flavilinea*.

Female.—Variable in the amount of ruddy suffusion on both head and abdomen; generally speaking, however, the coloration is (as in the male) somewhat deeper than found in typical *flavilinea*.

Holotype—♂, Firehole Riv., Upper Geyer Basin, Yellowstone Park, Wyo., July 29, (J. McDunnough); No. 3856 in the Canadian National Collection, Ottawa.

Allotype—♀, same locality, July 22.

Paratypes—5♀, same locality, July 21, 22.

Eventually this may prove to be merely a subspecies of *flavilinea*.

In the *heterocaudata* group two species have appeared in British Columbia according to our nymphal material; one is very close to *heterocaudata* and of this associations have been secured between nymph and adult; of the other only a single very striking nymph was collected.

The nymph of typical *heterocaudata* was described and figured by Walley (1930, *op. cit.* 15, Pl. 1, figs. 3a-d; Pl. II, figs. 4, 4a).

Ephemerella columbiella n. sp.

Nymph.—Very similar to that of *heterocaudata* in general form and maculation. Size slightly smaller; the dorsal tubercles, while of the same general blunt finger-like character, are much reduced in size, those of the gill-bearing segments being scarcely more than half the length of those in *heterocaudata* and those on segments 8-9 much reduced as compared with this latter species; the lateral setae, while showing considerable variation in length, are on the whole shorter than the normal length found in *heterocaudata*, and in consequence the middle seta is well over three times their length. The subcutaneous dark dorsal abdominal patches tend to spread out laterally along the anterior margins of the segments more so than in *heterocaudata*, and on the ventral surface the median dark band is broader and inclined to form diamond-shaped enlargements on each segment; the lateral dark stripes are also heavier.

Male.—Smaller than *heterocaudata* but with essentially the same type of abdominal maculation, this agreeing with that found in the nymph and consisting of hemispherical dark patches on anterior portion of each segment, gradually becoming reduced in size toward the caudal extremity and lacking on the last two segments; a series of dark lateral patches, tending to coalesce with the dorsal patches on anterior segments; the ground color is a light yellow brown, somewhat suffused with smoky on anterior half of abdomen; lateral edge light yellow, broadening posteriorly and tending to extend upward along the posterior edges of segments. Beneath pale yellowish with the dark median and lateral stripes reproduced from the nymphal stage. Tails smoky at base, the outer ones about two-thirds the length of the median one. Forelegs dull smoky with an amber tinge; mid and hind legs pale yellowish, the femora (especially of the mid-legs) tinged with smoky. Wings hyaline with pale venation. Length of fore wing 6 mm.

Female.—Maculation much as in male. Head pale yellowish tinged with brown and with blackish shading in central area. Outer tails shorter than in male, being less than one-half the length of the median one. Venation of fore-wing slightly more marked than in male.

Holotype.— ♂ , Trepanier Cr. Peachland, B. C., July 4, (A. N. Gartrell) (bred from nymph); No. 3857 in the Canadian National Collection, Ottawa.

Allotype— ♀ , same data, July 10.

Paratypes—5 ♂ , 3 ♀ , same data, July 4, 5, 7, 10, 22.

A detailed comparison of the adults with those of *heterocaudata* is difficult as we only possess one pair of this latter species (the types). Besides the somewhat larger size the male of *heterocaudata* seems to show in general more intense black coloration of the dark areas, especially on the sides of the posterior segments and on the pleura. There are, however, no very tangible differences and it is quite possible that *columbiella* will eventually prove to be merely a subspecies of *heterocaudata,* the differences being better defined in the nymph than in the adults.

I figure the male genitalia of the present species. Nymphs of this species were also taken in 1933 at Shuswap Falls, B. C., on Aug. 17; this locality is north-east of Vernon, and the later date is probably accounted for by the fact that the whole season of 1933 was a very late one in British Columbia.

Ephemerella hystrix Trav.

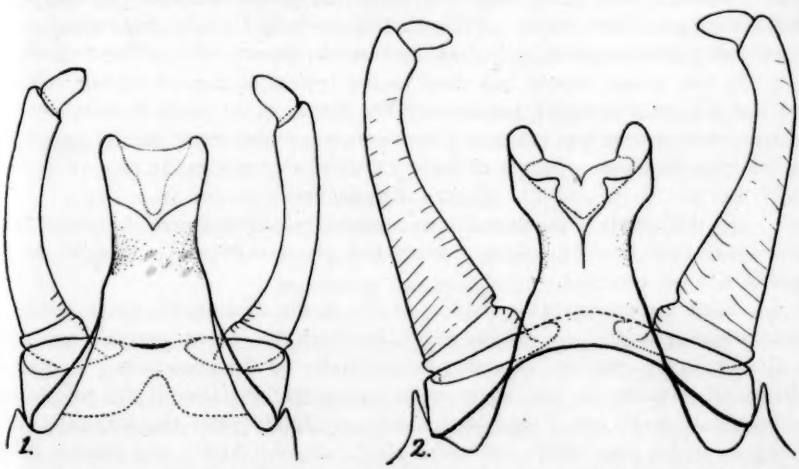
Before the appearance of Dr. Traver's paper (1934, Jour. Elisha Mitch. Sci. Soc. L, 212) I had drawn up a description of the nymph from a specimen secured on July 10 in Shingle Creek, near Keremeos, B. C., by Mr. Gartrell, with the intention of describing it as a new species. As my description supplements that of Traver's in certain respects I let it stand; I hardly think, however, when the adult is known, that it will fall in what Traver designates as the *"needhami* group"; judging by the difference in length of the tails it will probably show relationship to *heterocaudata* McD.

Nymph. Female.—Light ochre-brown. Head smooth, slightly marbled with paler on vertex; antennae pale yellowish. Prothorax considerably broader than head, roughly rectangular, outer edges gently convex; some darker lateral markings. Mesothorax broadening considerably to base of wing-pads, then gently narrowing; with slight dark median and submedian streaking. Abdomen slender; lateral posterior edges of segments drawn out to short blunt points; a double dorsal row of *long, slender, pointed* spines, bent slightly outwards and backwards situated on posterior margins of segments II-IX; those on II and III shorter and closer together; on IV-VII subequal and quite erect; on VIII and IX somewhat shorter and more flattened, all faintly spiculate apically. Gills on segments III-VII with oval, pale smoky opercula, that of VII much reduced in size. Black triangular dorsal patches based on anterior margin of each of segments I-VIII; segment IX largely black, except for a paler area around bases of spines; segment X with basal half blackish; lateral black patches on each of segments I-VIII. Ventrally light yellow-brown, crossed on segments II-VIII by broad lunate bands of black; segment IX largely blackish. Tails brown with a few short spines situated on each intersegmental area; the two outer tails are

slightly shorter than the median one, being about four-fifths its length. Legs light yellow-brown; all femora rather broad, subequal in length to tibiae, slightly marked with deeper brown on anterior surfaces and with small scattered spines on dorsal edges; tarsi tinged with blackish at distal extremities. Length of body 9 mm.; of median tail 8 mm.

Ephemerella hecuba Eat.

Mr. Gartrell was successful in rearing a small series of adults of this interesting species from nymphs taken at Faulder, near Summerland, B. C., emergence taking place October 16-18. The nymph has already been recorded from Utah by Needham (1927, Ann. Ent. Soc. Am. XX, 115) and I found it quite plentiful near Bozeman, Mont., in August, 1928. More recently a single specimen was taken in the Waterton River, Alta., and we can now record its occurrence in southern British Columbia.



Male genitalia of (1) *Ephemerella columbiella* n. sp.; (2) *Ephemerella hecuba* Eaton.

Shepherd, (1929, Can. Ent. LXI, 260) under this name gave detailed descriptions and figures of nymph and adults from Waddell Cr., Rancho del Oso, California. I doubt very much, however, whether he had the true *hecuba* before him as his nymph is stated to possess double dorsal rows of short tubercles on segments II-VII, the true *hecuba* being entirely without such; there is also considerable difference between his figure and Eaton's with respect to the lateral prolongations on the posterior segments. It might further be noted that his so-called adult male, judging particularly by the figures of fore-leg and genitalia, was probably a subimago; I know of no instance where the male fore-leg is of the same length as the other legs; in the true *hecuba* males before me the fore-leg is quite normal in character.

It seems advisable under these circumstances to present the following description of the male adult, drawn up largely from a specimen in alcohol; the nymph has already been adequately treated by both Eaton and Needham.

Male.—Head and thorax deep black-brown, the lateral edges of mesothorax tinged slightly with pale yellowish; pleura and sternum similarly black-brown

with a broad pale whitish-yellow area extending obliquely from base of forewing to base of fore-leg containing a small orange spot; similar pale areas at bases of mid and hind-legs. Abdomen dorsally smoky olive-brown with traces of a slightly ruddy median line and a series of large semioval ruddy brown lateral patches, which show faint shadings of pale yellowish above their dorsal edges; lateral and anterior edges of segments pale whitish-yellow. The latero-posterior angles of all segments but VIII and IX are not produced but segments V-VII show fine finger-like projections which are evidently the remains of nymphal gills; segment VII with a weak postero-lateral spine and segment IX with a much stronger one. Ventrally pale whitish-yellow, the anterior half of each segment crossed by a broad, curved band of ruddy brown. Forceps, basal plate and setae deep smoky. Forelegs long, deep smoky; tibia and combined tarsal joints subequal and each longer than femur. Mid and hind legs with femora largely smoky brown with a ruddy tinge and some pale yellowish shading basally; tibia dull amber; tarsi light smoky. Wings hyaline with light smoky tinge along costa; veins and crossveins moderately fine, dark smoky-brown. According to genitalia (fig. 2) the species would fall close to the typical section of *Ephemerella,* in spite of the great nymphal distinction. The shape of the penes is distinctly that of the *excrucians-invaria* group and the short terminal joint of the forceps points in the same direction. Length of body 12 mm.; of forewing 12 mm.

Genus **Ameletus**

In this genus a number of our western species are now definitely associated with their nymphs. Notes are herewith given on the early stages of certain species not yet recorded.

With the exception of *similior* McD. all the nymphs discussed belong in what might be termed the *validus* group, in which the femora are pale and show *a distinct brown quadrate or oval patch centrally* on the outer side. In contradistinction to these we find in the *velox* group that the femora are pale brown without any dark central patch but usually a slightly paler tinge apically; this group, to which *celer* McD., *celeroides* McD., *alticolus* McD., and *similior* McD. belong, is further distinguished by the lack of any definite dorsal patterns on the abdominal segments, the color being predominantly pale to dark brown. In the *validus* group the pattern on the dark segments consists of distinct pale oval spots and there is also a varying number of pale segments with only slight brown maculation.

Ameletus sparsatus McD.

Nymph. Male. Head sepia brown. Thorax similar in color with numerous dashes and spots of pale whitish color on both pro- and mesonotum. Abdomen dorsally with segment I brown. Segment II largely whitish with anterior margin brown, this color broadest in median section and showing two darker oblique streaks. *The three segments III-V brown,* with faint darker pair of submedian streaks and with distinct white markings as follows:—A pair of submedian spots above posterior margin, these spots fainter on segment V than on others, a spot in the antero-lateral corner, and the anterior half of the lateral edge. Segment VI brown, with the lateral portions broadly and triangularly white with a dark spot about middle of lateral edge. Segment VII with the anterior one-third brown from which two short submedian dashes project into

the whitish posterior two-thirds which is really a fusion medially of the white triangles of previous segment; dark lateral spot as on segment VI. *Segment VIII much as III but with pale maculation frequently reduced.* Segment IX unicolorous brown. Segment X whitish with brown streaks medially on both anterior and posterior margins. In some cases a pale median line can be traced on all segments. Ventrally segments III-VII brown with lateral edges largely whitish; a small white dot near antero-lateral corner, a white submedian patch or dash (rather variable in size) jutting from posterior margin into the dark area, becoming stronger on posterior segments and on VII extending across entire segment, separating a narrow lateral band of brown from the larger median patch. Segments VIII and IX brown with the small anterior pale dot of preceding segments. Forceps pale. Setae pale at base and apex, the entire median section black-brown. Legs pale with brown area at base of coxa, a brown central patch on outer side of femur, tibia faintly brown at base and tarsus deep brown at both base and apex; claw pale. Gills whitish with a thin blackish chitinous band *well within the dorsal margin* of gill, somewhat as in *alticolus* (1934, Can. Ent. 163, fig. d), but rather more so.

Female.—Much as in male but with tendency, especially in quite mature specimens, for the pale areas to become slightly suffused with brownish. In less mature nymphs the white spots are frequently larger than in the male.

Adults were reared from material taken at Oliver, B. C., in late May. The male genitalia are very similar to those of *aequivocus* (1934, Can. Ent. 160) but the lightly spotted forewings distinguish the species.

Ameletus cooki McD.

Nymph.—Head and thorax light brown, the latter streaked and spotted, much as usual, with pale whitish, these pale areas tending to fuse laterally on pronotum and posteriorly on mesonotum and consequently considerably more extended than in *sparsatus*. Abdomen dorsally with *segments II, III and IV-VIII largely whitish,* with small brown triangular patches or dashes situated subdorsally on anterior margin, these mostly connected at their bases by a brown band of varying width, not attaining lateral edges of segments; a faint brown triangular lateral patch on III and on VIII, a narrow brown band along posterior margin extending more broadly cephalad along lateral edge and sending out small subdorsal projections which frequently join with those from the anterior margin, thus forming streaks across entire segment. *Segments IV and V only* largely brown with pale maculation much as in *sparsatus,* i. e. faint median streak, a strong oval pair of subdorsal spots and a spot in antero-lateral corner. Segment IX deep brown with faint trace of median pale line and a small pale spot in antero-lateral corner. Segment X pale, broadly suffused with pale brown in median area. Ventrally largely pale, except segments VIII and IX which are crossed by broad curved bands of brown, leaving only small pale areas antero-laterally and postero-medially. Segments III-VII with pair of small brown submedian spots near anterior margin and a lateral brown streak, faint on VI and VII; at times small faint median brown patches on posterior margins which occasionally tend to join with the pair of spots to form horseshoe-like marks. Forceps and anal plate pale. Setae pale at base and apex with a broad deep brown median area, less broad, however, than in *sparsatus*. Legs marked much as in

sparsatus with the dark patch on femur somewhat reduced at times and the dark areas on tarsus extended. Gills much as in *sparsatus* but with the dark chitinous band slightly nearer dorsal margin.

Easily distinguished from *sparsatus* by the larger number of pale segments. Adults were bred from material collected in Shingle Creek, along the Keremeos road, early in August.

Ameletus validus McD.

Nymph.—Head black-brown. Thorax rather dull clay-brown with obscure paler markings. Abdomen dorsally with segment II pale with slight brown oblique subdorsal streaks frequently joined with dark shading along anterior edge. *Segments III-VI brown with three large oval whitish patches,* one median near anterior margin and the other two lateral and posterad of the median spot; a white mark in antero-lateral corner and lateral edge marked with white; pale markings considerably reduced on segment VI. Segments VII and VIII pale with narrow brown anterior margin and a pair of fine subdorsal streaks, obsolescent at times on VIII; a small central dark lateral spot. Segment IX brown, narrowly and irregularly whitish along anterior margin. Segment X pale with faint dark median markings. Ventrally *almost entirely pale with faint brown streak* along lateral edge of segment IX. Setae with the median one paler than the outer ones, which are light brown; a faint narrow darker band across median seta near middle. Legs pale, anterior pair faintly brown-tinted; fine brown bands at bases of femora and tibiae and at apex of tarsus; two anterior femora with oval brown spot on outer side about middle. Gills large, oval, pale, faintly tracheated and with a thin dark chitinous band well within dorsal edge, more so than in preceding species.

The *four* dark median abdominal segments with their characteristic maculation serve to easily distinguish the species; the pale ventral abdominal surface seems also a good character. The adult is one of the latest to appear in the fall, specimens being bred in late September from nymphs secured in Shingle Cr. Penticton, B. C.

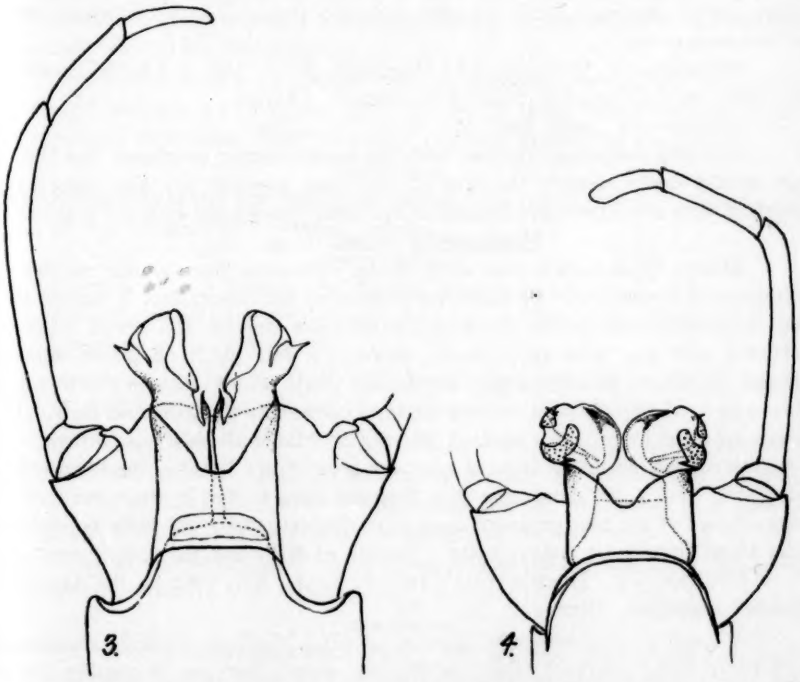
Ameletus similior McD.

Head deep brown. Thorax pale brown obscurely marked with light ochre-brown. Abdomen dorsally largely pale brown with obscure and rather variable maculation, segments IV, V and VIII considerably deeper brown, V at times with a small oval median pale spot. The maculation on the pale creamy-brown segments II, III and VI consists of the usual obscure darker subdorsal streaks which on VI may coalesce to form a median rectangular patch; on VII the posterior margin is brown sending lateral shoots upward to anterior margin, this forming dark lateral triangular patches, or at times the brown color extends over most of segments leaving only antero-lateral pale triangles; *segment VIII unicolorous deep brown with faint pale median line and small pale spot in antero-lateral corner. Segments IX and X pale,* the former with dark anterior margin extending downward in median line to form a small triangular patch, bisected by a faint pale line. Ventrally with segments III, IV, and VIII dark brown, others pale with faint dark lateral dashes and obscure submedian streaks uniting at times (especially on VIII) to form patches. A distinct row of median blackish ganglionic marks subcutaneously. Segment IX is practically entirely pale with

minute dark dot in antero-lateral corner. Setae pale at base, otherwise deep brown with somewhat paler apical section. Legs pale brown outwardly, paler on inner side; femora with pale streak extending backward from distal extremity; all tarsi with dark brown band apically. Gills narrowly oval, feebly tracheated, with chitinous thickening along both dorsal and ventral edges.

Apparently the most characteristic feature of the dorsal maculation is the dark eighth and the pale ninth and tenth segments. Considerable brown suffusion frequently exists which obscures the maculation as found in better-marked specimens.

Adults were bred in 1933 from nymphs collecting at 5000 ft. on Mt. Apex, near Hedley, B. C., and in 1934 from material found in Shingle Creek near Keremeos at lower altitudes.



Male genitalia of (3) *Iron dulciana* n. sp.; (4) *Heptagenia otiosa* n. sp.

Iron dulciana n. sp.

Male.—Light ochreous, the thoracic tergites shaded with pale brown; pronotum edged finely with black laterally and posteriorly, mesonotum with a faint orange-brown streak at lateral edge of anterior portion; pleura pale with two small black dashes at base of forewing; there are also two similar dashes at bases of each of the two hinder pairs of legs and a brownish streak, edged posteriorly with black, ascending obliquely from coxa of foreleg to pronotum. Abdomen pale, the posterior dorsal margins bordered finely with blackish. Foreleg trochanter pale with dark apical spot, femur light amber with prominent round

black spot at middle and slight dark shading apically, tibia and tarsi pale amber, with slight black shading at apex of tibia. Mid and hindlegs somewhat paler than fore ones, both coxae with a fine black apical point on outer side, in addition to which the hind coxa shows a dark basal streak; slight black streaks on both coxae on inner upper surface; all femora with median black spot and apical black shading, tarsal claws tinged with smoky. Wings hyaline with fine, pale venation, the crossveins only distinct in apical half of wing; the basal costal crossvein tinged with black.

Female.—Similar to male in general maculation, especially the black spotting on legs and pleura; orange-brown shading at base of foreleg and at latero-anterior edge of mesonotum rather intensified. Fore femur deeper in color than in male. Head with orange-brown shading on vertex posterior to ocelli. Crossveins on wings much better defined and distinctly visible over entire area; a slight smoky shading apically in pterostigmatic area. Length of body 7 mm.; of forewing 9 mm.

Holotype—♂, Trepanier Cr., Peachland, B. C., July 3, (A. N. Gartrell); No. 3883 in the Canadian National Collection, Ottawa.

Allotype—♀, same data, July 8.

The pale coloration together with the black spotting on pleura and base of legs should easily identify the species; the male genitalia are also quite characteristic with the latero-apical edges of the penes drawn out into sharp points.

Heptagenia otiosa n. sp.

Male.—Of a rather even dark brown coloration, very similar to that of *Rhithrogena jejuna* Eat. The anterior portion of the mesonotum is shaded with paler clay-brown and on the abdominal tergites the anterior and lateral areas are suffused with this same paler shade; there is a pale patch on pleura anterior to base of forewing. Forelegs with femora deep brown with a ruddy tinge; tibiae and tarsi slightly paler brown, the tarsi comparatively short and their entire length scarcely longer than that of the tibia. Mid and hind legs brown with a slightly darker shade at apex of each femur. Wings hyaline, the longitudinal veins fine, brown, the crossveins very fine and faint except in the outer half of wing; those of the pterostigmatic area most distinct; the costal veins beyond the bulla about 10 and not anastomosing. Length of body and forewing 7 mm.

Holotype—♂, Maupin, Ore., July 7, 1934; No. 3882 in the Canadian National Collection, Ottawa.

A small species evidently allied to *criddlei* McD. on genitalic characters. It is liable to be confused with *Rhithrogena* species but can be readily distinguished by the simple, non-anastomosing costal veins in the apical area of forewing.

HONORARY DEGREE FOR DOMINION ENTOMOLOGIST

The many friends of the Dominion Entomologist will be delighted to learn that the degree of Doctor of Laws was conferred on the Dominion Entomologist by Queens University at the recent convocation on May 8. This action is not only a fitting tribute to Dr. Gibson's long years of service in the Entomological Branch of the Dominion Department of Agriculture but is also a timely recognition of the important position occupied by Entomology among the biological sciences.

NOTES ON THE HOSTS AND PARASITES OF SOME LEPIDOPTEROUS LARVAE

BY WILLIAM L. PUTMAN,

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In an attempt to discover the native hosts of the parasites of the oriental fruit moth (*Grapholitha molesta* Busck) the larvae of a considerable number of microlepidoptera were collected and reared. The economic results of the work have been presented by the writer in a previous paper*; the present paper comprises a list of the lepidoptera which were reared, with their food plants and parasites. The lepidoptera were determined by Dr. J. McDunnough of the Entomological Branch, Ottawa, and the hymenoptera by Mr. G. S. Walley of Ottawa and the specialists of the United States Bureau of Entomology, Washington. The writer wishes to express his thanks to these gentlemen and also to Mr. D. F. Patterson of this laboratory and Mr. G. G. Dustan of the Ontario Fruit Branch, who assisted in making the collections.

The numbers and arrangement of the lepidoptera follow, as far as possible, Barnes and McDunnough's Check List. All the localities mentioned are located in the Niagara Peninsula. The dates refer to the emergence of the adults.

NOCTUIDAE.

2698 *Papaipema nebris* Gn. Vineland Station, Sept. 13-21, 1934. Larvae in gall at base of stem of *Ambrosia trifida*.

PYRALIDIDAE.

.... *Pyrausta ainsliei* Heinr. St. Davids, June 2-July 2, 1934. Larvae hibernating in stems of *Bidens cernua*; may have bred in *Polygonum* which was abundant in the vicinity.

5520 *Acrobasis kearfottella* Dyar. St. Davids, June 20-July 1, 1933. Larvae in tender twigs and petioles of *Carya ovata*.

5530 *Acrobasis stigmella* Dyar. St. Davids, June 20, 27, 1933. On *Carya ovata*.

5535 *Acrobasis sylviella* Ely? What was apparently this species emerged June 19-25, 1934, at St. Davids. Larvae on *Ostrya virginiana*, in a case of frass and silk beneath a tent-like cluster of webbed leaves.

5795 *Moodna ostrinella* Clem. St. Davids, July 20-Aug. 8 and later, 1934. In inflorescence of *Rhus typhina*.

PTEROPHORIDAE.

5857 *Pterophorus periscelidactylus* Fitch. St. Davids, June 21-July 7, 1932. On wild grape (*Vitis sp.*). Parasites: *Phorocera tortricis* Coq., June 27-29, 1932.

5860 *Pterophorus tenuidactylus* Fitch. St. Davids, June 24, 1932. On wild blackberry (*Rubus* sp.).

COSMOPTERYGIDAE.

5986 *Blastodacna curvilineella* Cham. St. Davids, May 29-June 12, 1933 In fruit of *Crataegus* spp. Parasites: *Eurytoma appendigaster* Swed., June 5, 1933.

*Notes on the Native Hosts of Some Oriental Fruit Moth Parasites. Can. Ent. 1935, LXVII, 46.

6006 *Mompha brevivittella* Clem. St. Davids, Sept. 21-Oct. 2, 1934. In seed capsules of *Oenothera biennis*. Parasites: *Bassus gibbosus* Say, Sept. 12-26, 1934.

6008 *Mompha eloisella* Clem. St. Davids, July 18-28, 1933. In stems of *Oenothera biennis*. Parasites: *Microbracon oenotherae* Mues.; *Epiurus pterophori* (Ashm.), May 26-June 5, 1933; *Chelonus lavernae* Ashm., June 16-29, 1934; *Orgilus* n. sp., June 23-July 18, 1933.

GELECHIIDAE.

.... *Telphusa praefixa* Braun. St. Davids, June 23, 1933. On *Vaccinium vacillans*.

6119.1 *Gnorimoschema chenopodiella* Bsk. St. Davids, July 20-24, 1934. Larvae on *Chenopodium album*, younger larvae leaf-miners, later tying leaves. Parasites: *Bassus cinctus* (Cress.), July 16-24, 1934; *Microbracon gelechiae* (Ashm.), July 16, 1934.

6199 *Anacampsis agrimoniella* Clem. St. Davids, June 25-July 9, 1934. Leaf-tier on *Agrimonia gryposepala*.

6353 *Anarsia lineatella* Zell. Peach Twig Borer. St. Davids. Parasites: *Copidosoma pyralidis* (Ashm.), Sept. 28, 1932.

6355 *Trichotaphe flavocostella* Clem. St. Davids, June 29, 1932. On *Solidago* spp.

6367 *Trichotaphe setosella* Clem. St. Davids, June 30, 1933. On *Solidago* spp. Parasites: *Copidosoma pyralidis* Ashm., July 7, 1933.

6380 *Dichomeris ligulella* Hbn. St. Davids, June 22-July 4, 1932. On *Carya ovata* and *Quercus rubra*.

OECOPHORIDAE.

6444? *Agonopteryx* sp. very close to *nigrinotella* Bsk. St. Davids, July 16, 1934. Leaf-roller on *Zanthoxylum americanum*.

EUCOSMIDAE.

6779 *Polychrosis viteana* Clem. Grape Berry Moth. Vineland Station. On wild grape (*Vitis* sp.). Parasites: *(Dioctes) Inareolata obliterata* (Cress), July 31-Aug. 6, 1929; *Glypta mutica* Cush., May 29-June 1, 1933.

6782 *Polychrosis slingerlandana* Kft. St. Davids, May 28-June 11, 1934. In inflorescence of *Eupatorium perfoliatum*.

6798 *Exartema permundanum* Clem. St. Davids, June 29-July 7, 1932. On *Rubus* spp. and *Vaccinium vacillans*.

6803 *Exartema appendiceum* Zell. St. David's, June 10, 1933. On *Hamamelis virginiana*.

6807 *Exartema inornatanum* Clem. St. Davids, June 24-July 17, 1933; June 11, 1934. On *Prunus serotina* and *P. virginiana*. Parasites: *Macrocentrus nigridorsis* Vier., June 24, 1933; *Glypta simplicipes* Cress., June 24-26, 1933.

6809 *Exartema footianum* Fern. St. Davids, June 20, 1933. On *Hamamelis virginiana*.

6810 *Exartema merrickanum* Kft. St. Davids, June 10, 1933. On *Hamamelis virginiana*.

.... *Exartema cornanum* Heinr. St. Davids, June 28, 1932; June 20, 1934. On *Cornus paniculata*. Parasites: *Ephialtes conquisitor* (Say), July 2, 1933.

.... *Exartema viburnana* McD. St. Davids, June 23-30, 1933. On *Viburnum lentago*. Parasites: *Glypta exartemae* Walley, June 20-26, 1933.

6827 *Endothenia hebesana* Wlk. St. Davids, Sept. 3-Oct. 2, 1934. In seed capsules of *Frasera caroliniensis*.

6847 *Hedia chionosema* Zell. St. Davids, June 19, 1933. On *Crataegus* sp.

6869 *Argyroploce bipartitana* Clem. St. Davids, June 5, 1933. On *Trifolium pratense*.

6981 *Epiblema strenuana* Wlk. General throughout the Niagara Peninsula, May 23-July 9, July 30-Sept. 4, 1934. Stalk-borer in *Ambrosia artemesifolia*. Parasites: (All 1934) *Glypta rufiscutellaris* Cress., Aug. 1-Sept. 10; *Macrocentrus delicatus* Cress., June 16-22, Aug. 2-Sept. 11; *Macrocentrus ancylivorus* Roh., Aug. 27; *Cremastus minor* Cush., Aug. 20-Sept. 1; *Cremastus epagoges* Cush., Aug. 18-31; *Epiurus pterophori* (Ashm.), Aug. 8-Sept. 4; *Microbracon* 2 spp., Aug. 20-Sept. 5, Aug. 29-Sept. 3; *Eurytoma* sp., June 29-July 3 and Aug. 16-Sept. 26; *Phytomyptera leucoptera* Johns, Aug. 8-18.

7026 *Epiblema otiosana* Clem. St. Davids and Vineland Station, June 19-July 13, 1934. In stems of *Bidens frondosa* and *Bidens cernua*. Parasites: (All 1934) *Epiurus pterophori* (Ashm.), May 20-23; *Bassus simillimus* Cress., June 9-July 14; *Macrocentrus pallisteri* DeGant, June 5-16.

7110 *Episimus argutanus* Clem. St. Davids, June 1-23, Aug. 8, 1934. Rolling leaves and in inflorescence of *Rhus typhina*.

7130 *Proteoteras aesculana* Riley. St. Davids, Niagara-on-the-Lake, July 16-26, 1932, Aug. 27-Sept. 11, 1934; two generations. Boring in tender twigs and petioles of *Acer negundo*. Parasites: *Epiurus pterophori* (Ashm.), June 29, 1932; (*Dioctes*) *Inareolata obliterata* (Cress.), June 29, 1932.

7170 *Spilonota ocellana* D. & S. Eye-spotted Budmoth. In addition to apple, this species was also reared from wild rose (*Rosa* sp.) at St. Davids.

7185 *Ancylis comptana* Froel. Strawberry Leaf Roller. Reared from wild rose (*Rosa* sp.) at St. Davids.

7207 *Laspeyresia caryana* Fitch. St. Davids, Aug. 28-Sept. 5, 1933. In husks of *Carya ovata*. Parasites: *Calliephialtes grapholithae* (Cress.) Aug. 28-Sept. 6, 1933, May 28-29, 1934; *Glypta rufiscutellaris* Cress., June 6, 1934; *Macrocentrus laspeyresiae* Mues., Aug. 28-Sept. 5, 1933; *Eurytoma tylodermatis* Ashm., May 29-June 1, 1934.

7208 *Grapholitha prunivora* Wlsh. Lesser Apple Worm. St. Davids, in apple and wild crab (*Pyrus coronaria*). Parasites: (All 1932) *Glypta rufiscutellaris* Cress., Oct. 1; *Ascogaster carpocapsae* Vier., Oct. 8-14; *Perilampus fulvicornis* Ashm., Oct. 16.

7210 *Grapholitha interstinctana* Clem. Clover Seed Caterpillar. St. Davids, July 24-Tug. 1, 1933. Parasites: *Bassus annulipes* (Cress.), July 21, 1933.

7238 *Grapholitha packardii* Zell. Cherry Fruit Worm. St. Davids, Niagara-on-the-Lake, Aug. 8-26, 1932. In fruit of cultivated red cherry. Parasites: (All 1932) *Glypta rufiscutellaris* Cress., Aug. 8-18; *Ascogaster carpocapsae* Vier., *Psychophagus omnivorus* (Wlk.) Aug. 16.

7270 *Carpocapsa pomonella* Linn. Codling Moth. Parasites: *Perilampus fulvicornis* Ashm., St. Davids, Oct. 8, 1932; *Ascogaster carpocapsae* Vier.

FAMILY TORTRICIDAE.

7288 *Sparganothis pettitana* Rob. St. Davids, June 21-July 9, 1932. On *Tilia americana*. Parasites: *Ephialtes conquisitor* (Say), June 26, 1934.

7291 *Sparganothis niveana* Wlshm. St. Davids, June 16-19, 1934. In *Ostrya virginiana*.

7296 *Sparganothis diluticostana* Wlshm. St. Davids, June 20-23, 1933. On *Prunus virginiana* and *Viburnum lentago*.

7316 *Sparganothis sulfureana* Clem. St. Davids and Vineland Station, June 5-30, 1933; Sept. 3, 1934. On *Trifolium pratense, Medicago sativa, Monarda mollis, Solidago* spp., *Aster novae-angliae, Erigeron annuus, Ambrosia artemesiifolia*.

7336 *Pandemis limitata* Rob. St. Davids, on *Cornus paniculata*.

7340 *Cacoecia rosana* Linn. St. Davids, June 19-26, 1934. On *Crataegus* sp., *Quercus rubra, Cornus paniculata*.

7349 *Cacoecia cerasivorana* Fitch. St. Davids, June 27-July 10, 1933. On *Prunus virginiana*. Parasites: *Exochus pallipes* Cress., July 16-26, 1932; *Phytomyptera leucoptera* Johns, July 18-26, 1932; *Phorocera tortricis* Coq.

7356 *Cacoecia fractivittana* Clem. St. Davids, June 3-6, 1933. On *Fagus grandifolia* and *Quercus rubra*. Parasites: *Macrocentrus amicroplodes* Vier; June 12, 1933.

7358 *Cacoecia purpurana* Clem. St. Davids, June 27-29, 1933. On *Smilacina racemosa* and *Erigeron annuus*.

7361 *Cacoecia rosaceana* Harr. Oblique-banded Leaf Roller. Reared at St. Davids from *Trifolium pratense, Viburnum lentago, Cornus paniculata,* and *Ostrya virginiana*.

7366 *Tortrix pallorana* Rob. St. Davids, June 5-July 6, 1933. *On Monarda mollis, Prunus serotina, Aster novae-angliae, Solidago* spp., *Erigeron annuus, Medicago sativa, Melilotus alba, Trifolium* spp. Parasites: *Glypta rufofaciata* Cress., June 19-23, 1934; *Epirhyssalus atriceps* (Ashm.), June 20, 1933; *Actia interrupta* Curran.

7367 *Tortrix clemensiana* Fern. St. Davids, June 8-19, 1934. On *Aster novae-angliae* and *Solidago* sp. Parasites: *Glypta rufofasciata* Cress., June 19-23, 1934

7364 *Eulia quercifoliana* Fitch. St. Davids, June 20, 1933. On *Quercus rubra*.

7390 *Eulia velutinana* Wlk. St. Davids, July 10, 1933. On *Rosa* sp.

7399 *Eulia juglandana* Fern. St. Davids, July 1, 1932; June 2-9, 1934. On *Carya ovata*.

7409 *Argyrotoxa albicomana* Clem. St. Davids, June 19-July 3, 1934. On *Rosa* spp. Parasites: *Ephialtes conquisitor* (Say), June 26, 1934.

7409.1 *Argyrotoxa curvalana* Kft. St. Davids, June 13-30, 1933. On *Vaccinium vacillans* and *Gaylussacia baccata*.

7409.2 *Argyrotoxa semipurpurana* Kft. St. Davids, June 10-24, 1933; June 12-19, 1934. On *Quercus rubra* and *Q. coccinea.* Parasites: *Glypta rufiscutellaris* Cress., June 19-20, 1934.

7420 *Peronea schalleriana* var. *viburnana* Clem. St. Davids, June 25-26, 1934. On *Viburnum lentago.*

HELIODINIDAE.

7573 *Schreckensteinia erythriella* Clem. St. Davids, July 20-Aug. 8 and later, 1934. In inflorescence of *Rhus typhina.*

GLYPHIPTERYGIDAE.

.... *Simaethis pariana* Clerck. Apple and Thorn Skeletonizer. Parasites: (*Dioctes*) *Inareolata obliterata* (Cress.), St. Davids, June 19, 1932; *Microbracon gelechiae* (Ashm.), July 5, 1932.

7695 *Argyresthesia oreasella* Clem. St. Davids, June 16-21, 1933. Boring in young twigs of *Prunus virginiana.* Parasites: (*Dioctes*) *Inareolata obliterata* (Cress.); *Microgaster canadensis* Mues., May 23, 1933; *Elachertus aeneoniger* Gir., June 5, 1933.

7721 *Xyrosaris celastrusella* Kft. St. Davids, June 24-27, 1932; June 6-20, 1933. Webbing young growth of *Celastrus scandens.* Parasites: (*Dioctes*) *Inareolata obliterata* (Cress.), June 10, 1932.

GRACILARIIDAE

8042 *Gracilaria rhoifoliella* Cham. St. Davids, Aug. 18-28, 1933. Leaf roller on *Rhus typhina.*

The following parasites were reared from unidentified hosts or from mixed collections:

Apanteles cacoeciae Riley. St. Davids, June 21, 1932, from leaf roller on quince.

Apanteles canarsiae Ashm. St. Davids, June 28, 1932, from leaf roller on *Cornus paniculata.*

Apanteles ornigis Weed. St. Davids, July 19, 1932, from leaf roller on *Rhus typhina.*

Bassus annulipes (Cress.). St. Davids, June 29, 1932, from collection of *Eulia juglandana* and *Dichomeris ligulella.*

Meteorus dimidiatus (Cress.). St. Davids, June 5, 1933, from a mixed collection of leaf rollers on clover.

Cryptopristes lazulella Ashm. July 17.

Systolodes brevicornis Ashm. July 7-17.

Microbracon mellitor (Say).

Microbracon tenuiceps Mues. July 7.

The above four species were reared at St. Davids, 1933, from clover heads containing larvae of *Laspeyresia interstinctana* Clem., *Phytonomus meles* Fab., *P. nigrirostris* Fab., *Tychius picirostris* Fab., and other species.

Phytodietus burgessi (Cress.), St. Davids, June 22, 1933, from collection of *Tortrix pallorana* and *Sparganothis sulfureana.*

AN APPARENTLY NEW PHERNE FROM CALIFORNIA (LEPID., GEOMET.)*

BY J. MCDUNNOUGH,
Ottawa, Ontario.

Among the material sent for identification by Mr. J. L. Sperry was a small series of what appears to be a new species of *Pherne;* at any rate the specimens do not agree with any of the three species at present listed under this generic name and figured in the Barnes and McDunnough "Contributions" III, Pl. XV, figs. 7, 8, 14. As is usual the antennae are bipectinate in both sexes, the pectinations in the female being distinct but much shorter than in the male; the palpi are distinctly shorter than in *subpunctata* Hlst.; the apical portion of the outer margin of primaries is less excavated and the angle at vein 5 less sharp than in the other members of the genus. I can find no hair pencil on the hind tibia of the male although, according to Hulst's diagnosis, this is a characteristic of the genus; however, there appears to be none in *subpunctata,* the only species of which males are available for examination at the present time, and which is distinctly congeneric with the other species. On account of the general similarity of maculation the species seems best placed in the genus *Pherne.* I describe it as follows:—

Pherne sperryi n. sp.

Male. Head, thorax and primaries pale creamy, the latter lightly suffused with olive-ochreous; median area broader than in allied species and shaded, next to the t. a. and t. p. lines, with deeper olive-ochreous than the ground color, this darker shade more or less defining these lines. T. a. line from costa at about one-third, with sharp outward angle immediately below costa and then slightly inwardly oblique to inner margin at one-third; t. p. line from costa at three-quarters, parallel to outer margin to vein 5, rather abruptly incurved to vein 3 and then perpendicular to inner margin at two-thirds; fringes unicolorous light ochreous. Secondaries scarcely angled, silky whitish, with slight ochreous tinges along outer margin and very faint traces of a discal dot. Beneath primaries whitish, slightly tinged with ochreous along costa and in apical area; t. p. line of upper side more or less defined, especially in costal half of wing. Secondaries whitish, faintly sprinkled with ochreous and with traces of an angled dark ochreous postmedian line (not always present). Expanse 26-29 mm.

Female. Rather more heavily suffused on primaries with ochreous than in the male, especially in the median area, where there is also a trace of a small oblique discal dash; t. p. line more gently sinuate and median area in consequence definitely broader. Secondaries and underside much as in male, the postmedian angled line of underside of secondaries being frequently lacking. Expanse 30-33 mm.

Holotype—♂, Providence Mts., Calif., Apr. 5, 1934, (Grace and J. L. Sperry); No. 3936 in the Canadian National Collection, Ottawa, through the courtesy of the collectors.

Allotype—♀, same data.

Paratypes—1 ♂, 5 ♀'s, same data, one male and three females of which are deposited in the Sperry Collection.

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*Contribution from the Division of Systematic Entomology, Entomological Branch, Department of Agriculture, Ottawa.

Two of the female paratypes show a sprinkling of ochreous scales on the primaries in contradistinction to the rather even suffusion of this color found in the other specimens and in one of these the angulation at vein 5 of primaries is slightly more pronounced.

THE GENUS CIDAPHUS IN CANADA (HYMEN.; ICHNEUMONIDAE)

BY G. STUART WALLEY,
Ottawa, Ont.

In 1924 (Proc. U. S. N. M. Vol. 64, Art. 20, pp. 4-6) Cushman reviewed the North American species of *Cidaphus* pointing out diagnostic characters for the separation of *C. paniscoides* from two species which he described as new under the names *C. occidentalis* and *C. australis*. At that time the only Canadian record for a member of the genus was that of the female type specimen of *occidentalis* from Revelstroke, B. C. The distribution given for *paniscoides*, N. H., N. Y., Pa. and Md. indicated that this species also probably would be found to occur in Canada.

In assembling the National Collection material in this genus the writer was delighted to find that both *paniscoides* and *occidentalis* were represented and also a third species which appeared to be undescribed. During the course of this study the writer was able to examine the type of *occidentalis* and Mr. Cushman has also kindly supplied additional data enabling me to characterize the new Canadian species. Notes on the Canadian members of the genus are as follows:

Cidaphus paniscoides (Ashm.)

A single female specimen was taken in a light trap at Merivale, Ont., September 27, 1930 (J. J. deGryse). The structure of the first abdominal segment (Cushman, *op. cit.* fig. 2a) will readily distinguish this species from the following.

Cidaphus occidentalis Cush.

Cidaphus occidentalis Cushman, Proc. U. S. Nat. Mus., LXIV, Art. 20, p. 5, 1924.

The following localities are represented by material in the Canadian National Collection. Chilcotin, B. C., Aug. 21, 1918 (W. B. Anderson), Salmon Arm, B. C., Aug. 20, 1925 (A. A. Dennys), Banff, Alta., Aug. 22, 1922 (C. B. D. Garrett), Bilby, Alta., Aug. 2, 1924 (O. Bryant), Edmonton, Alta., July 2, 24, 25, 1932 (O. Peck), Abitibi Region, N. Que. (Dr. Cook), Montreal, Que. (Winn).

This species has been previously recorded only from the type locality Revelstroke, B. C., and from Pullman, Wash. Two of my Edmonton specimens are males; except for sexual differences they agree very well with Cushman's original description of the type. In addition to the characters mentioned in the original description I note the following structural characteristics which are useful in separating *occidentalis* from the species described below. Vertex fully two-thirds as broad as face; temples broadly convex, distinctly broader than greatest diameter of lateral ocellus; apical and subapical segments of maxillary palpus of equal length; costulae complete but sometimes rather weak.

Contribution from the Division of Systematic Entomology, Entomological Branch, Department of Agriculture, Ottawa.

Cidaphus melleus n. sp.

Very similar to *occidentalis* Cush. and agreeing with the original description of that species except in the following respects.

Female—Length 12.5 mm.

Propodeum with costulae only very weakly indicated adjacent areola, entirely absent beyond; petiole with glymma less strongly rugose toward base; vertex slightly less than two-thirds as broad as face; temples flat and very short, distinctly shorter than greatest diameter of lateral ocellus except at upper extremity of eye; apical segment of maxillary palpus five-sixths as long as subapical segment.

Color as in *occidentalis* except the face which is pale brownish throughout.

Male—Temples rounded as in *occidentalis* but a little shorter than in that species.

Holotype—♀, Mer Bleue (Ottawa region) Ont., July 18, 1933 (G. S. Walley). No. 3853 in the Canadian National Collection, Ottawa, Ont.

Allotype—♂, Covey Hill, Que., July 2, 1924 (G. S. Walley).

Paratypes—♀, Trenton, Ont., Sept. 17, 1904 (Evans) at light; ♀, Constance Bay, Ont., July 20, 1933 (G. S. Walley); ♂, Bobcaygeon, Ont., June 26, 1932 (J. McDunnough); ♂, (locality unknown), Harrington Collection; ♂, 2♀♀, Merivale, Ont., July 3, 20, Sept. 11, 1930 (J. J. deGryse) taken in light trap. Paratype in the United States National Museum.

BOOK NOTICES

"Insect Physiology," by V. B. Wigglesworth. Methuen & Co. Ltd., London.

This pocket size monograph of 134 pages and 13 illustrations fills a long vacant gap in entomological literature. The general functions of the organs and tissues are presented in an interesting and logical manner. No attempt has been made to incorporate unessential specializations or qualifying instances which might tend to obscure the general principles. A bibliography of approximately 300 recent references is included.

"Veterinary Helminthology and Entomology," by H. O. Monnig, B.A., Dr. Phil., B.V.Sc. Bailliere, Tyndall & Cox, London.

This new text in parasitology emphasizes the parasitic diseases of domestic animals rather than the morphology of the parasites concerned. Although the greater part of the text deals with helminth parasites, about 120 pages and 90 illustrations deal with the arthropods. Where possible the life cycle, pathogenesis, symptoms, and suggestions for treatment and prophylaxes are given. Although written primarily for veterinarians, this book should prove a convenient reference for entomologists concerned with the pests of domestic animals.

Date of Mailing, June 7, 1935.